

What is claimed is:

1. A hydraulic section for a solenoid valve, comprising:

a valve body, said valve body having fluid supply and outlet ports on an end face;

an inlet flange and an outlet flange secured to said valve body, each of said inlet

5 and outlet flanges including a fluid port, said inlet flange fluid port communicating with said fluid supply port and said outlet flange fluid port communicating with said fluid outlet port;

a piston disposed within said valve body, said piston having a central bore therethrough, said piston moveable between open and closed positions to control fluid communication between said fluid supply and outlet ports;

10 a pair of shear seal rings sealingly disposed within said piston bore, said shear seal rings having a central bore therethrough; and,

a supply seal plate and an outlet seal plate, said supply seal plate having a port therethrough allowing fluid communication between said inlet flange fluid port and said shear seal rings central bore, said outlet seal plate having a port therethrough allowing

15 fluid communication between said outlet flange fluid port and said shear seal rings central bore.

2. A hydraulic section for a solenoid valve, according to Claim 1, including:

a piston spring disposed within said valve body and coaxial with said piston;

an end cap secured to said valve body, said end cap maintaining said piston spring

20 in engagement with said piston; and,

said piston spring urging said piston to a closed position.

3. A hydraulic section for a solenoid valve, according to Claim 2, wherein:

said pair of shear seal rings having a spring coaxially positioned between said pair of shear seal rings to urge said shear seal rings into sealing engagement with said supply and outlet seal plates, and;

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each of said pair of shear seal rings has a tapered inner diameter.

4. A hydraulic section for a solenoid valve, according to Claim 3, wherein:

said outlet seal plate port therethrough allowing fluid communication between said outlet flange fluid port and said shear seal rings central bore includes first and second fluid passages disposed on opposite sides of said outlet seal plate and allowing fluid flow therebetween;

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said first fluid passageway is disposed on the side of said outlet seal plate adjacent said shear seal rings central bore and said first fluid passage way is arcuate in cross section; and,

5       said second fluid passageway is disposed on the side of said outlet seal plate adjacent said outlet flange fluid port and said second fluid passage way is circular in cross section.

5. A hydraulic section for a solenoid valve, according to Claim 4, wherein:

said tapered inner diameters of said shear seal rings face said supply seal plate and said outlet seal plate.

10       6. A hydraulic section for a solenoid valve, according to Claim 5, wherein:

said arcuate cross section of said first fluid passageway of said outlet seal plate has an inner and an outer radius; and,

15       said outer radius of said arcuate cross section of said first fluid passageway of said outlet seal plate is substantially equal to the radius of said tapered outlet face of said shear seal rings.

7. A hydraulic section for a solenoid valve, according to Claim 6, wherein:

20       said outer radius of said arcuate cross section of said first fluid passageway of said outlet seal plate is substantially coincident to the radius of said tapered outlet face of said shear seal ring when said piston is moved to an open position to allow fluid communication between said fluid supply and outlet ports.

8. A hydraulic section for a solenoid valve, according to Claim 7, wherein:

said piston has a plurality of seal rings disposed in said central bore therethrough; and,

25       said plurality of seal rings sealing the annulus between said piston bore and the exterior of said shear seal rings disposed in said piston bore.

9. A hydraulic section for a solenoid valve, according to Claim 8, wherein:

30       said supply seal plate port therethrough allowing fluid communication between said inlet flange fluid port and said shear seal rings central bore includes first and second fluid passages disposed on opposite sides of said supply seal plate and allowing fluid flow therebetween;

said first fluid passageway is disposed on the side of said supply seal plate adjacent

said inlet flange fluid port and said first fluid passage way is circular in cross section; and,  
said second fluid passageway is disposed on the side of said supply seal plate  
adjacent said shear seal rings central bore and said second fluid passageway is circular in  
cross section.

5           10. A hydraulic section for a solenoid valve, according to Claim 9, wherein:  
said circular cross sections of said first and second fluid passages of said supply  
seal plate are of different diameters.

11. A hydraulic section for a solenoid valve, according to Claim 10, wherein:  
said circular cross section of said first fluid passageway of said supply seal plate is  
10 contained within the diameter of said tapered outlet face of said shear seal ring when said  
piston is moved to an open position to allow fluid communication between said fluid supply  
and outlet ports.

12. A coil section for a solenoid valve, comprising:  
a coil cover, said coil cover having a substantially cylindrical shape with a mounting  
15 flange disposed on one end;  
a solenoid section disposed within said coil cover, said solenoid section including an  
electrically operated coil, a fixed metal core and a moveable metal core axially positioned  
a predetermined axial distance from said fixed metal core, said fixed metal core sealed at  
one end to the interior of said coil cover;

20 a pressure transfer cap arrayed on said coil cover on the opposite end from said  
mounting flange;  
a bore extending axially through said fixed metal core;  
a plunger positioned within said bore and extending from said bore a predetermined  
distance at either end, said plunger being impacted and moved by said moveable metal  
25 core when said electrically operated coil is energized;

a flux ring encircling a portion of said moveable core and sealed thereto; and,  
a pair of electrical leads supplying power to said electrically operated coil.

13. A coil section for a solenoid valve, according to Claim 12, further comprising:  
said pressure transfer cap which is deformable to accommodate pressure changes  
30 within said coil section.

14. A coil section for a solenoid valve, according to Claim 13, wherein:

said pair of electrical leads extending through said pressure transfer cap and being sealed by said pressure transfer cap.

15. A coil section for a solenoid valve, according to Claim 14, including:

5 a predetermined amount of dielectric fluid within said coil section, said dielectric fluid displacing any air within said coil section, and preventing ingress of foreign matter into said coil section.

16. A coil section for a solenoid valve, according to Claim 15, wherein:

said fixed metal core and said moveable metal core have complimentary tapered faces on their mating faces.

10 17. A coil section for a solenoid valve, according to Claim 16, further including: securing means securing said solenoid section within said coil cover.

18. A coil section for a solenoid valve, according to Claim 17, further including: a plurality of fill ports for filling said coil section with said dielectric fluid.

19. A solenoid valve, comprising:

15 a hydraulic section having a moveable piston for controlling fluid flow between a fluid supply and a controlled apparatus;

a coil section moving said moveable piston between open and closed positions in response to an electrical signal;

20 a manifold positioned between said coil section and said hydraulic section, said coil section and said hydraulic section secured to said manifold;

said hydraulic section comprising;

a valve body, said valve body having fluid supply and outlet ports on an end face;

25 an inlet flange and an outlet flange secured to said valve body, each of said inlet and outlet flanges including a fluid port, said inlet flange fluid port communicating with said fluid supply port and said outlet flange fluid port communicating with said fluid outlet port;

30 a piston disposed within said valve body, said piston having a central bore therethrough, said piston moveable between open and closed positions to control fluid communication between said fluid supply and outlet ports;

a pair of shear seal rings sealingly disposed within said piston bore, said shear seal rings having a central bore therethrough;

5 a supply seal plate and an outlet seal plate, said supply seal plate having a port therethrough allowing fluid communication between said inlet flange fluid port and said shear seal rings central bore, said outlet seal plate having a port therethrough allowing fluid communication between said outlet flange fluid port and said shear seal rings central bore; and, said coil section comprising;

10 a coil cover, said coil cover having a substantially cylindrical shape with a mounting flange disposed on one end;

a solenoid section disposed within said coil cover, said solenoid section including an electrically operated coil, a fixed metal core and a moveable metal core axially positioned a predetermined axial distance from said fixed metal core, said fixed metal core sealed at one end to the interior of said coil cover;

15 a pressure transfer cap arrayed on said coil cover on the opposite end from said mounting flange;

a bore extending axially through said fixed metal core;

20 a plunger positioned within said bore and extending from said bore a predetermined distance at either end, said plunger being impacted and moved by said moveable metal core when said electrically operated coil is energized;

a flux ring encircling a portion of said moveable core and sealed thereto; and,

25 a pair of electrical leads supplying power to said electrically operated coil.

20. A solenoid valve, according to Claim 19, wherein:

said hydraulic section further comprises;

30 a piston spring disposed within said valve body and coaxial with said piston;

an end cap secured to said valve body, said end cap

maintaining said piston spring in engagement with said piston;  
said piston spring urging said piston to a closed position; and,  
said coil section further comprises;  
said pressure transfer cap which is deformable to accommodate  
pressure changes within said coil section.

21. A solenoid valve; according to Claim 20, wherein:

said hydraulic section further comprises;

said pair of shear seal rings having a spring coaxially positioned  
between said pair of shear seal rings to urge said shear seal rings into  
sealing engagement with said supply and outlet seal plates;

each of said pair of shear seal rings has a tapered inner  
diameter; and,

said coil section further comprises;

said pair of electrical leads extending through said pressure  
transfer cap and being sealed by said pressure transfer cap.

22. A solenoid valve, according to Claim 21, wherein:

said hydraulic section further comprises;

said outlet seal plate port therethrough allowing fluid  
communication between said outlet flange fluid port and said shear seal  
rings central bore includes first and second fluid passages disposed on  
opposite sides of said outlet seal plate and allowing fluid flow  
therebetween;

said first fluid passageway is disposed on the side of said outlet  
seal plate adjacent said shear seal rings central bore and said first fluid  
passage way is arcuate in cross section;

said second fluid passageway is disposed on the side of said  
outlet seal plate adjacent said outlet flange fluid port and said second  
fluid passage way is circular in cross section; and,

said coil section further comprises;

a predetermined amount of dielectric fluid within said coil  
section, said dielectric fluid displacing any air within said coil section,

and preventing ingress of foreign matter into said coil section.

23. A solenoid valve, according to Claim 22, wherein:

said hydraulic section further comprises;

said tapered inner diameters of said shear seal rings face said  
supply seal plate and said outlet seal plate; and,

said coil section further comprises;

said fixed metal core and said moveable metal core having  
complimentary tapered faces on their mating faces.

24. A solenoid valve, according to Claim 23, wherein:

said hydraulic section further comprises;

said arcuate cross section of said first fluid passageway of said  
outlet seal plate having an inner and an outer radius;

said outer radius of said arcuate cross section of said first fluid  
passageway of said outlet seal plate is substantially equal to the radius  
of said tapered outlet face of said shear seal rings; and,

said coil section further comprises;

securing means securing said solenoid section within said coil  
cover.

25. A solenoid valve, according to Claim 24, wherein:

said hydraulic section further comprises;

said outer radius of said arcuate cross section of said first fluid  
passageway of said outlet seal plate is substantially coincident to the  
radius of said tapered outlet face of said shear seal ring when said  
piston is moved to an open position to allow fluid communication  
between said fluid supply and outlet ports; and,

said coil section further comprises;

a plurality of fill ports for filling said coil section with said  
dielectric fluid.

26. A solenoid valve, according to Claim 25, wherein:

said hydraulic section further comprises;

said piston having a plurality of seal rings disposed in said

central bore therethrough; and,

said plurality of seal rings sealing the annulus between said piston bore and the exterior of said shear seal rings disposed in said piston bore.

5 27. A solenoid valve, according to Claim 26, wherein:

said hydraulic section further comprises;

said supply seal plate port therethrough allowing fluid communication between said inlet flange fluid port and said shear seal rings central bore includes first and second fluid passages disposed on opposite sides of said supply seal plate and allowing fluid flow therebetween;

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said first fluid passageway is disposed on the side of said supply seal plate adjacent said inlet flange fluid port and said first fluid passage way is circular in cross section; and,

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said second fluid passageway is disposed on the side of said supply seal plate adjacent said shear seal rings central bore and said second fluid passageway is circular in cross section.

28. A solenoid valve, according to Claim 27, wherein:

said hydraulic section further comprises;

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said circular cross sections of said first and second fluid passages of said supply seal plate are of different diameters.

29. A solenoid valve, according to Claim 28, wherein:

said hydraulic section further comprises;

said circular cross section of said first fluid passageway of said supply seal plate is contained within the diameter of said tapered outlet face of said shear seal ring when said piston is moved to an open position to allow fluid communication between said fluid supply and outlet ports.

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